

What is claimed is:

- 1 1. A voice detector comprising:
 - 2 a plurality of Goertzel filters each operating at a different frequency
 - 3 within a voice range, some of the filters operating at frequencies of control
 - 4 signals and others of the filters operating at frequencies other than the
 - 5 control signals' frequencies, each filter for receiving a signal to be
 - 6 analyzed for presence of voice and detecting energy of the signal at the
 - 7 operating frequency of the filter; and
 - 8 a comparator connected to the filters, for comparing the energies
 - 9 detected by the filters against thresholds and responsive to at least three
 - 10 of the filters simultaneously detecting energy above a noise threshold and
 - 11 below a control signal threshold by indicating that the signal comprises
 - 12 voice.
- 1 2. The voice detector of claim 1 wherein:
 - 2 the comparator is responsive to a filter of the filters operating at a
 - 3 frequency of a control signal and detecting energy above a control signal
 - 4 threshold by indicating that the analyzed signal comprises the control
 - 5 signal.
- 1 3. The voice detector of claim 1 wherein:
 - 2 the comparator is responsive to one of the filters operating at a
 - 3 frequency of a single-frequency control signal detecting energy above a
 - 4 first control signal threshold by indicating that the analyzed signal
 - 5 comprises the single-frequency control signal, and is responsive to two of
 - 6 the filters operating at frequencies of a dual-frequency control signal each
 - 7 detecting energy above a second control signal threshold different from
 - 8 the first control signal threshold by indicating that the analyzed signal
 - 9 comprises the dual-frequency control signal.

1 4. The voice detector of claim 1 further comprising:
2 a detector that detects total energy of the signal to be analyzed;
3 wherein

4 the comparator is responsive to the total detected energy being
5 below a noise threshold by indicating that the analyzed signal comprises
6 noise or silence.

1 5. The voice detector of claim 4 wherein:
2 the comparator compares the energies detected by the filters
3 against the thresholds by comparing ratios of the energies detected by
4 individual ones of the filters and the total detected energy against the
5 thresholds.

1 6. A call classifier comprising:
2 a plurality of Goertzel filters each operating at a different frequency
3 within a voice range, some of the filters operating at frequencies of control
4 signals and others of the filters operating at frequencies other than the
5 control signals frequencies, each filter for receiving windows of a signal to
6 be analyzed for presence of voice and detecting energy of the signal in the
7 windows at the operating frequency of the filter;

8 a detector that detects in the windows total energy of the signal to
9 be analyzed; and

10 a comparator connected to the filters, for comparing ratios of the
11 energies detected by the individual filters in a window and the total
12 detected energy in the window against thresholds, responsive to the total
13 detected energy in the widow not exceeding a noise threshold by
14 indicating that the analyzed signal comprises silence or noise, responsive
15 to one of the filters operating at a frequency of a single-frequency control
16 signal detecting energy whose ratio exceeds a first control signal threshold
17 by indicating that the analyzed signal comprises said single-frequency
18 control signal, responsive to two of the filters operating at frequencies of a

19 dual-frequency control signal each detecting energy whose ratio exceeds
20 a second control signal threshold by indicating that the analyzed signal
21 comprises said dual-frequency control signal, and responsive to at least
22 three of the filters each detecting energy whose ratio exceeds a voice
23 threshold by indicating that the signal comprises voice.

1 7. The call classifier of claim 6 wherein:
2 each window represents a different segment of the signal to be
3 analyzed.

1 8. The call classifier of claim 6 wherein:
2 each window represents a different tapered segment of the signal
3 to be analyzed.

1 9. The call classifier of claim 6 wherein:
2 each window represents a different segment of the signal to be
3 analyzed and wherein consecutive said windows partly overlap each
4 other.

1 10. A method of detecting voice in a signal to be analyzed for
2 presence of voice, comprising:
3 detecting energy of the signal at operating frequencies of a plurality
4 of Goertzel filters each operating at a different frequency within a voice
5 range with some of the filters operating at frequencies of control signals
6 and others of the filters operating at frequencies other than the control
7 signals' frequencies;
8 comparing the energies detected by the filters against thresholds;
9 and
10 in response to at least three of the filters simultaneously detecting
11 energy above a noise threshold and below a control signal threshold,
12 indicating that the signal comprises voice.

1 11. The method of claim 10 further comprising:
2 in response to a filter of the filters operating at a frequency of a
3 control signal detecting energy above a control signal threshold, indicating
4 that the analyzed signal comprises the control signal.

1 12. The method of claim 10 further comprising:
2 in response to one of the filters operating at a frequency of a single-
3 frequency control signal detecting energy above a first control signal
4 threshold, indicating that the analyzed signal comprises the single-
5 frequency control signal; and
6 in response to two of the filters operating at frequencies of a dual-
7 frequency control signal each detecting energy above a second control
8 signal threshold different from the first control signal threshold, indicating
9 that the analyzed signal comprises the dual-frequency control signal.

1 13. The method of claim 10 further comprising:
2 detecting total energy of the signal to be analyzed;
3 comparing the total detected energy against a noise threshold; and
4 in response to total detected energy being below the noise
5 threshold, indicating that the analyzed signal comprises noise or silence.

1 14. The method of claim 13 wherein:
2 comparing the energies detected by the filters comprises
3 comparing ratios of the energies detected by individual ones of the
4 filters and the total detected energy against the thresholds.

1 15. A method of detecting voice in a signal to be analyzed for
2 presence of voice, comprising:
3 detecting energy of the signal at operating frequencies of a plurality

4 of Goertzel filters each operating at a different frequency within a voice
5 range, some of the filters operating at frequencies of control signals and
6 others of the filters operating at frequencies other than the control signals
7 frequencies, wherein each filter receives windows of the signal to be
8 analyzed for presence of voice and detects energy of the signal in the
9 windows at the operating frequency of the filter;
10 detecting in the windows total energy of the signal to be analyzed;
11 comparing ratios of the energies detected by the individual filters in
12 a window and the total detected energy in the window against thresholds;
13 in response to the total detected energy in the widow not exceeding
14 a noise threshold, indicating that the analyzed signal comprises silence or
15 noise;
16 in response to one of the filters operating at a frequency of a single-
17 frequency control signal detecting energy whose ratio exceeds a first
18 control signal threshold, indicating that the analyzed signal comprises said
19 single-frequency control signal;
20 in response to two of the filters operating at frequencies of a dual-
21 frequency control signal each detecting energy whose ratio exceeds a
22 second control signal threshold, indicating that the analyzed signal
23 comprises said dual-frequency control signal; and
24 in response to at least three of the filters each detecting energy
25 whose ratio exceeds a voice threshold, indicating that the signal
26 comprises voice.

1 16. The method of claim 15 wherein:
2 each window represents a different segment of the signal to be
3 analyzed.

1 17. The method of claim 15 wherein:
2 each window represents a different tapered segment of the signal
3 to be analyzed.

- 1 18. The method of claim 15 wherein:
- 2 each window represents a different segment of the signal to be
- 3 analyzed and wherein consecutive said windows partly overlap each
- 4 other.